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Jenner's Centenary and His Contribution to Public Health

Lecture by

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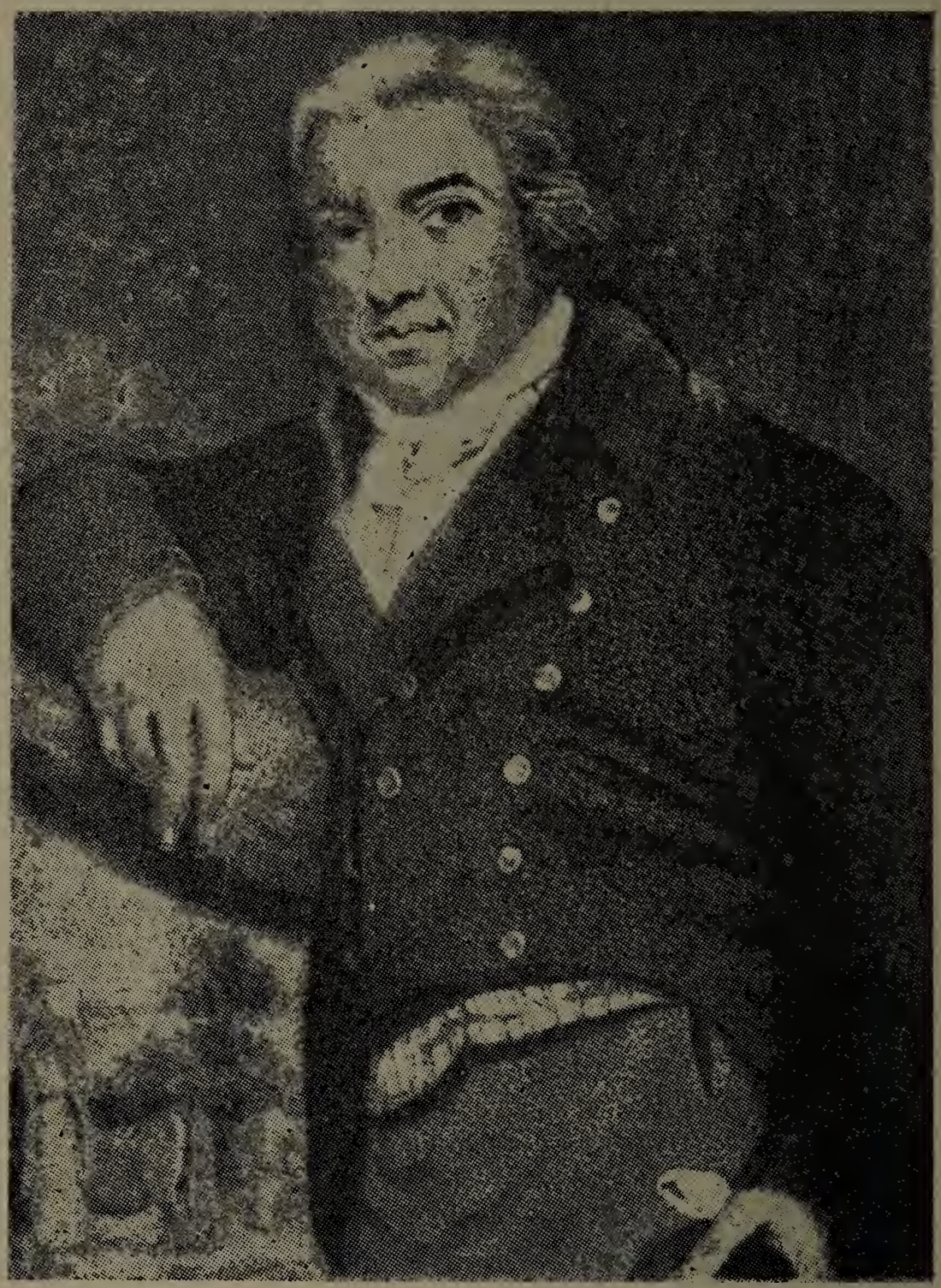

EDWARD JENNER, M.D., F.R.S.

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Two hundred years ago, on May 17, 1749, Edward Jenner, the discoverer of vaccination against small-pox, was born at Berkeley in Gloucester. Through the use of his method, which was efficient at its inception and has passed with little modification and with unaltered effectiveness to our day, one of the world's great pestilences was overcome. For this, Jenner must be regarded as one of the supreme benefactors of mankind.

Jenner was a distinguished forerunner of modern Preventive Medicine, an acknowledged influence on the later immunological work of Pasteur, and a first delver into the field of study of the virus infections. As well he was the pattern of a capable and trusted country doctor, a born naturalist, and a modest and lovable figure. At a conference of health workers, such as this, in the bicentenary of his birth, it is an honour to recall his life and work.

Early Life and Education

Edward Jenner was the son of a rural clergyman in Gloucestershire. After some preliminary education, at about the age of 13 he was apprenticed to the craft of medicine under Daniel Ludlow, a surgeon of Sodbury near Bristol, and in the following years pursued the usual training for a general practitioner of the time. He accompanied and assisted his master in the work of his country practice, studied pharmacy and surgery under him, and doubtless in his spare time engaged in the natural history that had interested him since his school days and which was to be a lifelong pursuit.

In 1770, at the end of his apprenticeship and when he was 21 years, Jenner went to London for further training, and fortunately became the pupil of John Hunter, studying under him at St. George's Hospital, and living for two years in his house at Jermyn Street. Hunter, the master surgeon, remains one of the greatest figures in British medicine. He was a distinguished comparative anatomist and pathologist, and his lifelong study and experiment, and his application of science to the practice of surgery,

greatly influenced the development of his craft. He was a great collector and left the Hunterian Collection of the Royal College of Surgeons of England, largely destroyed by enemy bombs in 1942, as one of his least substantial monuments, for his work is woven into the fabric of surgery. The influence of this great teacher upon the young Jenner must have been profound, and his large house crammed with natural history specimens gathered from all over the world, his experiments on the structure and habits of animals, his menagerie at Brompton, all must have enchanted the country youth, interested in natural history from his earliest days.

In 1772, his training completed, despite the attractions of London Jenner returned to his native village of Berkeley. Here, except for short periods, he practised as the local doctor for the remainder of his days. Some three years after his return he received an invitation from Hunter to lecture in comparative anatomy at his school in London, but this tempting offer, as the many that followed later in the days of his triumph, could not attract him from his village. Here he lived the full life of a busy practitioner, obtained the M.D. of St. Andrews in 1792, engaged in local affairs and was interested in music, poetry and natural history. From the accounts of his life there emerges the figure of a warm and friendly country-man, and capable doctor, rejoicing in his home and family, respected by his circle of friends and colleagues, and interested in the welfare of his people.

The Study of Natural History.

Throughout his life Jenner pursued the study of natural history, receiving from it the background of careful enquiry, and the training in observation and experiment, that led to the discovery for which we honour him.

His competence must early have impressed Hunter for apart from the later offer of an assistantship, Jenner, while still a student, received through him a post which indicated the master's appreciation. In 1771 Captain Cook returned from his first voyage, after his discovery of these eastern coasts in the "Endeavour," bringing with him the great collections of Banks and Solander, a large part of which had been gathered about Botany Bay. Through Hunter's influence with his friend Joseph Banks, Jenner was given the part-time task of arranging the botanical specimens. The duplicates of this collection were, towards the end of last century, presented to this State by the British authorities, and are now lodged at the Sydney Herbarium. Jenner's work must have been well done, for he was later offered the post of naturalist with Cook's second expedition, which sailed in 1772, but was not to be drawn from the country life he had set his heart upon.

A friendship which was established between Jenner and his famous master in his student days endured till the latter's death in 1793, and they corresponded regularly. The letters from Hunter to Jenner, preserved in the Royal College of Surgeons of England, show the high regard and the continued influence of Hunter. They are mainly about natural history — criticising experiments, begging or acknowledging the specimens for which he was avid for his work and collections, or requesting information. An idea of their nature can be gained from a frequently quoted letter of August 2, 1775:

> *"I thank you for your experiment on the hedgehog; but why do you ask me a question by the way of solving it. I think your solution is just; but why think? Why not try the experiment? Repeat all the experiments upon a hedgehog as soon as you receive this, and they will give you the solution . . . and let me know the result of the whole."*

Even important personal affairs could not displace from his letters the master's passion for the work, for after Jenner had apparently written in grief and disappointment at the breaking off of his projected marriage, he replied:

> *"I own I was glad when I heard you was married to a woman of fortune; but 'let her go, never mind her.' I shall employ you with hedgehogs, for I do not know how far I may trust mine. I want you to get a hedgehog in the beginning of winter."*

and then he sets out the details of an experiment, and makes no further mention of Jenner's trouble.

Jenner's natural history studies included work on the habits of the cuckoo, hibernation in the hedgehog, and the migration of birds. For his work he was elected F.R.S. in 1789.

He had the curiosity of the true research student, was trained in observation, and deeply interested in the workings of nature. His discovery of vaccination was no accident.

Small-pox Before the 19th Century

Before the introduction of vaccination small-pox was one of the most deadly diseases. Its high contagiousness and mortality, the horror of its manifestations, the frequent aftermath of scarring and the constancy of its threat to all who had not already suffered an attack caused it to be deeply dreaded. It smouldered in the cities, breaking at intervals into widespread epidemics. Its heavy toll appeared year after year in the bills of mortality. It had a fatality of one death in each six or seven cases attacked, and probably from half to five-sixths of the population suffered at one time or another. In 1749, the year of Jenner's birth, it was respon-

sible for 10.3% of all deaths occurring in London, and in 1798, the year of the appearance of his work on vaccination, it caused 12% of the London deaths. All classes were affected and it entered the palaces as well as the homes of the poor.

Some idea of the extent of the small-pox mortality before Jenner can perhaps be gained from a mention of some of its royal victims, though they could be expected to have whatever advantages were available. Two children of Charles I of England died of small-pox and three of James II, including Queen Mary (1694) the wife of William III. William III's father and mother also died of small-pox, and like Queen Anne, he himself survived a serious attack. His contemporary Louis XIV of France also recovered from a severe attack, and his son the Dauphin, his grandson the Dauphin, and his great grandson Louis XV (1774) all died of it. In the Court of Austria the Emperor Joseph I (1711) died of small-pox, and two empresses, an Elector of Bavaria (1777), an Elector of Saxony and a ruler of Prussia (1767) Peter II, Emperor of Russia (1727) and the Queen of Sweden (1741) were also claimed by this disease.

The historian Macaulay, who was born in 1800, two years after Jenner's publication on vaccination, was stirred to the following description:

> "That disease over which science has since achieved a succession of glorious and beneficial victories, was the most terrible of all the ministers of Death. The havoc of the plague had been far more rapid, but plague has reached our shores only once or twice within living memory, and small-pox was always with us, filling the churchyard with corpses, tormenting with constant fear all those it had not stricken, leaving on those whose lives it spared the hideous traces of its powers, turning the babe into a changeling at which the mother shuddered, making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

Medical purists have demurred at some points in this passage. For example it has been disputed that residual pock scars were as frequent as is suggested. But it nevertheless reflects the feeling of pre-Jennerian writers.

Prevention by Inoculation

For about a century before the adoption of vaccination some protection from small-pox had been achieved in England by the use of an ancient Eastern practice of immunisation by the application of material from a case of true small-pox. This was called inoculation or variolation. The former term was adopted by analogy with the grafting of trees, the transferred material in the latter being the buds or "eyes" — oculi.

This method, which is said to be still practised in parts of Africa and the East, was in 1714 reported to the Royal Society by Timoni. In 1717 impetus was given to its use by Lady Mary Wortley Montagu, wife of the British Ambassador at Constantinople, who described it in a letter:

> *"The small-pox so fatal and so general amongst us is here entirely harmless by the process of "ingrafting," which is the term they give it. People send to one another to know if any of their family has a mind to have small-pox; they make parties for this purpose. The old woman comes with a nut-shell of the best sort of smal-pox and asks what vein you please to have opened. She immediately rips what you offer her with a large needle and puts into the vein as much matter as can lie on the head of her needle, and in this manner opens four or five veins. The children or young patients . . . are in perfect health till the eighth day. Then the fever begins to seize them and they keep to their beds two days, seldom three. They have rarely above 20 or 30 on their faces which never mark, and in eight days they are as well as before their illness. Every year thousands undergo this operation. There is no example of anyone who has died of it, and you may well believe I am satisfied of the safety of the experiment, as I intend to try it on my dear little son. I am patient enough to take pains to bring this useful invention into fashion in England."*

Upon her return to England in 1718 Lady Mary advocated inoculation to court and society with a vivid energy worthy of one who was called the "she-meteor" by Horace Walpole. One child had been inoculated in the East, her other was now treated at home. As a result of her efforts the method was tried with success on six condemned criminals from Newgate, who were afterwards released. Then, after further satisfactory trials, two children of the Royal Family were inoculated, and the method came into limited use. It was availed of mainly by the wealthy, who could afford the long treatment and isolation required. In 1746 a hospital was opened for the inoculation of the poor in London, and in 1754 the Royal College of Physicians sanctioned the practice.

The method usually employed was to introduce material from an early small-pox lesion into a scratch or incision. This induced an attack of small-pox itself, with subsequent immunity. In most cases the attack was mild, some lowering of the virulence of the virus apparently occurring in the process. But occasionally severe cases resulted, and a mortality of from 1 to 6% was incurred. A further drawback was the liability of the spread of small-pox from inoculated cases, which were not less contagious than those naturally acquired. Though some form of isolation was usually practised, inoculated persons sometimes went free in the towns, with

1949 CONFERENCE

AN

INQUIRY

INTO

THE CAUSES AND EFFECTS

OF

THE VARIOLÆ VACCINÆ,

A DISEASE

DISCOVERED IN SOME OF THE WESTERN COUNTIES OF ENGLAND,

PARTICULARLY

GLOUCESTERSHIRE,

AND KNOWN BY THE NAME OF

THE COW POX.

BY EDWARD JENNER, M.D. F.R.S. &c.

——— QUID NOBIS CERTIUS IPSIS
SENSIBUS ESSE POTEST, QUO VERA AC FALSA NOTEMUS.

LUCRETIUS.

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1798.

Title Page of
Jenner's INQUIRY, 1798.

dire results. In France this was recognised, and after a severe outbreak of small-pox in Paris in 1763 which was ascribed to this cause, inoculation was not allowed in the city. Patients were obliged to reside in the country, "where they might reap the advanage of this operation, without destroying their neighbours."

From its restricted use inoculation had little effect on small-pox in the mass of the population. It was continued in England until 1840, when it was prohibited by law.

Cowpox and Vaccination.

From the days of his apprenticeship Jenner had been interested in a Gloucestershire country tradition that, following infection with the cow-pox, milkmaids thereafter did not suffer from small-pox. This he considered for many years, finally conducting the investigations which proved that cow-pox infection protected against the small-pox, and which led to the practice he called vaccination.

Jenner first set out to show that the cow-pox which was naturally acquired by dairy workers gave them protection. As he practised inoculation upon his patients when suitable small-pox cases were available, he was able to show this by the absence in previous cow-pox sufferers of reaction to the small-pox material.

Then followed, in 1796, his first vaccination experiment. He took material from a cow-pox lesion on the finger of Sarah Nelmes, a milkmaid, and with it inoculated an eight-year-old boy, James Phipps. The cow-pox took successfully, and about seven weeks later the boy was inoculated from a case of small-pox, without result.

In 1797 Jenner submitted his results in a paper to the Royal Society, but this was returned, presumably on account of the apparent slightness of his evidence. Further work was added, and in 1798 he published his magnum opus under the title of "An Inquiry into the Causes of the Variolae Vaccinae, a Disease Discovered in Some of the Western Counties of England, particularly Gloucestershire, and Known by the Name of the Cow Pox." A second edition appeared in 1800, a third in 1801, and the book was widely translated.

This brief sketch of Jenner's work may perhaps lead it to appear that this was merely the facile proving of the milkmaids' tale. But the work had gone far beyond the obvious implications of this. For Jenner had considered not only the protection of individuals by transferred matter from the pocks of cows. Indeed this had actually already been done by Benjamin Jesty, a Dorsetshire farmer, in 1774. Jenner envisaged as well, by passing the cow virus from person to person, the protection of whole populations. He clearly saw in it the means of ending the menace of small-pox to the race.

There was much to consider before the work was done. Did the naturally acquired cow-pox protect against small-pox, as the tale suggested? Did artificially acquired cow-pox protect? Could

the cow-pox virus be passed from arm to arm, protecting at each passage? This would get rid of the necessity for having an infected cow conveniently at hand always, and allow of widespread use. There was necessary a study of cow-pox itself, the selection of lesions that gave certain immunity.

After publication of the "Inquiry" Jenner, sure of the facts, went to London to demonstrate the efficiency of his discovery. He remained some months, without obtaining any volunteers willing to be vaccinated, and returned to his village. But the surgeon Henry Cline, to whom he had given some lymph, announced its success. As well the method was enthusiastically taken up by Lettsome, one of the most distinguished physicians of his time, and by others. Within a few months it was widely utilised.

During its rapid adoption vaccination received frequent setbacks. Some of these were due to faulty selection in lesions in the cow as a source of lymph, to errors in technique, and to too early exposure to small-pox following vaccination. Once there was even the contamination of lymph with small-pox itself, at the Small-pox Hospital. And coincidental with its enthusiastic reception and extending use, there arose a vehement opposition, expressed in professional criticism, personal attacks, caricatures and lampoons. The tail-end of this is continued by a few silly persons, regardless of all evidence, to the present day.

Although Jenner's thesis was founded on a small number of cases, within a short time its efficiency was proven beyond all doubt in wide usage. In the early days a large proportion of the persons vaccinated were later submitted to small-pox to test its effectiveness. In 1801 Jenner wrote "upwards of 6,000 persons have now been inoculated with the virus of cow-pox, and the far greater part of them have since been inoculated with that of small-pox, and exposed to its infection in every rational way that could be devised, without effect." In 1799/1801, 7,500 persons were vaccinated at the Small-pox Hospital, of whom about half were later unsuccessfully inoculated with small-pox.

Time showed that the immunity gained from vaccination was not of life-long persistence, as Jenner had averred. It gradually waned, but could be restored by re-vaccination.

Vaccination was rapidly adopted in Europe and America, and its use was soon world-wide. In the years that have passed the method has been little changed. It remains, as Jenner presented it, a sure protection from small-pox to all who use it.

Small-pox and Vaccination in Early New South Wales

In 1789, a year after the establishment at Port Jackson of the first settlement in Australia, a severe epidemic of small-pox was reported in the aborigines in the vicinity. A heavy mortality

resulted, and the bodies of natives were found about the harbour shores. A coloured sailor of the "Supply," who died of the disease, was the only settler affected. The infection became widespread throughout the south-eastern part of the continent. As small-pox had not been recorded on the outward voyage of the First Fleet, many theories arose as to its origin, including its introduction by unrecorded infection in the Fleet, by the ships of Cook or La Perouse, by navigators touching at the West or Macassar fishers in the North, or from an indigenous source. In a review of these Cumpston thought that without further evidence the most satisfactory theory was that the outbreak was "in some way associated with the arrival in Australia of a comparatively large number of Europeans." As Tench mentioned that "our surgeons had brought out variolous matter in bottles," presumably for inoculation, this also could not be neglected as a possible source, though there is no record of its use.

A second severe epidemic broke out among the aborigines in Victoria and South Australia in 1830, and was said to have persisted till 1845. The first Australian cases in whites occurred in association with this. No further unequivocal European cases are recorded until 1857, when infection was brought by ship to Victoria, and resulted in 16 cases with 4 deaths. During this outbreak an act was passed in Victoria for the compulsory notification of small-pox. A Vaccination Act was already law.

A third great epidemic in natives occurred in Northern Australia between 1860 and 1869, and might reasonably be ascribed to Malay trepang fishers.

It will be remembered that Jenner was a pupil of John Hunter when Cook returned from his "Endeavour" voyage in 1771. The early settlement at Port Jackson had already been established about 10 years upon his publication of the "Inquiry" in 1798. The successful and widespread acceptance of vaccination within a few years of its inception was reflected in early Sydney, for in 1803 Governor King requested that the Secretary of State should send out a supply of "vaccine matter" to the Colony. He stated that "every search has been made on the teats of our cows but nothing of the kind can be found." The material arrived in 1804, and three children were at once vaccinated by Thomas Jamison, the Principal Surgeon of the Colony, and others by Surgeon John Harris of the N.S.W. Corps and Assistant-Surgeon Savage. These were the first vaccinations to be made in Australia. They were successful, and on 3rd June 1804 the following notice appeared in the **Sydney Gazette:**

NOTICE

As the cow-pox is now fully established in the colony, it is hoped no parent or guardian of any children will omit availing themselves of so great a blessing which, as has been shown . . . is an infallible preventative against that generally fatal distemper, the smallpox.

Small-pox.
(From Ricketts and Byles, "Diagnosis of Small-pox.")

In the same issue also appeared the following notice:

Such children as the parents or guardians may wish to have inoculated are to attend at Parramatta on Tuesday and Wednesday next; after which a permanent attendance will be directed at Sydney, Parramatta and Hawkesbury.

In 1804 Governor King, when sending lymph to Norfolk Island, wrote that vaccination "had succeeded so well that most part of the children in the Colony have now received the inoculation."

In this year there appeared in the Sydney Gazette the first medical article to be printed in Australia. It was written by Thomas Jamison, the Principal Surgeon, and was called "General Observations on the Smallpox." It included a severe warning to the colonists — "I have no doubt that should the disease ever visit this colony in the natural state, and particularly in the Summer season, it would carry off nine-tenths of those who might receive the infection." Then followed the offer of vaccination, "the blessing held out to them by the provident care of the parent country," "an infallible preventative of that loathsome, disgusting and too often fatal disease."

Later in 1804 Jamison advertised a scheme for vaccinating the children of distant settlers. In repeating this notice on account of inadequate response, he warned parents that if they did not bring forward their children, the "vaccine virus" would be lost, for an unbroken chain of patients was required for its maintenance. This was also utilised for its transport on long sea voyages, a succession of vaccinations, from one to another, being made during the passage.

From time to time the virus was lost in the Colony, new stocks being obtained from England or Norfolk Island. Arm to arm transference of lymph was used until 1881. About this time calf lymph came into use, and a vaccine laboratory for its supply was established in Victoria. Lymph was not manufactured in New South Wales until 1898, when a Pasteur Institute was opened in Sydney, and functioned for some years.

In 1884 an almost facsimile copy of the 1800 edition of Jenner's "Inquiry" was published by the Government Printer, Sydney, following representations to the Premier by a body of medical men. This followed the Sydney small-pox epidemic of 1881/2, the worst in Australian history, in which there were 154 cases with 40 deaths. The edition was announced to be for the information of doctors and the general public, although it was probably intended especially for the education of local legislators. For during the epidemic, despite the exhaustive examination of medical evidence on the value of vaccination by New South Wales Cabinet committees, and against the continued advice of their medical advisors, no legislative powers on vaccination were enacted by the State Parliament, as had already been done in all other Australian States. A locally inserted preface said, with perhaps unintended frankness, that the book would

Small-pox. A patient's vaccinated baby has escaped infection. (from Gamlin, "Modern School Hygiene.")

provide "the evidence upon which Vaccination was adopted by every civilised Government in the world."

After Jenner

Though Jenner had forged a great weapon for the Public Health, his work stood alone in its field for many years. It was not until 80 years had passed that the great Pasteur took up the subject of artificially induced immunity which Jenner had introduced, and with the hand of genius developed it.

In the meantime in England, amid the appalling conditions born of the Industrial Revolution — poverty, degradation, overcrowding, filth and disease — there arose the Sanitary Idea and the modern concept of the Public Health. The health of the people, from the concern of ardent reformers became the responsibility of the State. Organised sanitation sweetened the unsewered, undrained cities, the polluted water supplies, the reeking overcrowded courts. In this period of Reform a host of evils were overthrown by humane men. Among these were the English pioneers of Public Health, Chadwick, Southwood Smith, Simon, Arnott, Duncan, Percival and the rest. More great names stood out as modern Public Health evolved — William Farr the statistician, Pringle the father of military hygiene, Lind the conqueror of scurvy, good John Howard the prison reformer, Thakrah and industrial hygiene, William Budd who before bacteriology told how typhoid fever spread and John Snow who did the same for the cholera, Ferriar and Florence Nightingale.

But it was not till Pasteur, already famous for his work on chemistry, fermentation, and the diseases of silkworms, turned to medical investigation in 1877 that Jenner's work was extended. Pasteur studied this, and considered the application of its principles to other diseases. From this developed his methods for the attenuation or enfeeblement of disease causing organisms, so that they could be safely introduced into the body to raise its immunity against subsequent attacks from virulent forms. This he employed against fowl cholera, anthrax and rabies, these organisms being attenuated by various methods.

The meaning of the term "vaccination," originally introduced by Jenner as a name for his method, was extended by Pasteur to refer to any prophylactic inoculation. This was referred to by the French master in an address in London in 1881:

> *"I have given to the term vaccination an extension which Science, I hope, will consecrate as a homage to the merit of and to the great services rendered by one of the greatest of Englishmen, your Jenner. I am happy to be able to praise this immortal name . . ."*

All men do not praise his name to-day, since largely through his work, the foul disease he conquered is unknown to them. But all men who know small-pox, and all who are responsible for its control, and those who see behind the white pages of his writings the great and kindly figure, will continue to say, with his colleague, "Dear, dear Edward Jenner!"

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